

# **MACKIE®**

## **Glossary**

of pro audio terms



# Glossary

This Glossary contains brief definitions of many of the audio and electronic terms and acronyms used in discussions of sound mixing and recording. Many of the terms have other meanings or nuances or very rigorous technical definitions, which we have sidestepped here because we figure you already have a lot on your mind.

If you'd like to get more information, there are plenty of useful textbooks out there. We recommend the following titles: *The Audio Dictionary* by Glenn White, *Tech Terms* by Peterson & Oppenheimer, *Handbook for Sound Engineers* by Glen Ballou, *Mackie Mixer Book* by Rudy Trubitt, *Pro Audio Reference* by Dennis Bohn, and *Sound Reinforcement Handbook* by Gary Davis.

## A

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### ACRONYM

An acronym for A Contrived Reduction Of Nomenclature Yielding Mnemonics

### adiabatic

Literally, it means "not to pass through." In describing the high-density foam used inside the HR Series studio monitors, it means that internal reflections within the cabinet are absorbed by the foam. In physical terms, it means the mechanical energy of the sound wave is converted into heat energy.

### A/D converter (ADC)

Analog-to-digital converter, a device that transforms incoming analog signals into digital form.

### AFL

An acronym for After Fade Listen, which is another way of saying post-fader solo function.

### aliasing

This is a type of distortion caused during the analog-to-digital conversion process. If the frequency of the analog signal exceeds one-half the sampling rate, spurious signals and harmonics not present on the original signal may be created (see Nyquist Theorem). Careful design and filtering before the sampling stage can reduce this aliasing to a minimum.

### assign

In sound mixers, assign means to switch or route a signal to a particular signal path or combination of signal paths.

### attenuate

To reduce or make quieter.

### aux

Short for Auxiliary.

### auxiliary

In sound mixers, supplemental equipment or features that provide additional capabilities to the basic system. Examples of auxiliary equipment include: serial processors (equalizers, compressors, limiters, gates) and parallel processors (reverberation and delay).

### aux send

A mixer bus output designed to send a signal to an auxiliary processor or monitor system.

### aux return

A mixer input (sometimes a pair of inputs) with limited control capabilities, intended for bringing the output of an auxiliary processor or other line-level source into the main mix bus. Aux returns can sometimes be assigned to other buses in the mixer.

## B

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### balanced input

An input consists of two leads, neither of which is common to the circuit ground. This is a “differential pair”, where the signal consists of the *difference* in voltage between the two leads. Balanced input circuits can offer excellent rejection of common-mode noise induced into the line.

### balanced output

In a classic balanced audio circuit, the output is carried on two leads (high or + and low or -) which are isolated from the circuit ground by exactly the same impedance.

A symmetrical balanced output carries the same signal at exactly the same level but of opposite polarity with respect to ground.

A special case of a balanced output carries the signal on only one lead, with the other lead being at zero voltage with respect to ground, but at the same impedance as the signal-carrying lead. This is sometimes called *impedance balanced*.

### bandwidth

The band of frequencies that pass through a device with a loss of less than 3 dB, expressed in Hertz or in musical octaves. Also see *Q*.

### bit

The smallest component of a digital word, represented by either a one or a zero.

### bridged mono

A mode of operation for a stereo amplifier that routes a single input to both channels, but inverts the signal on channel 2, thereby providing twice the voltage of an individual output by connecting the speaker between the two positive output terminals (the negative output terminals are not used).

## bus

An electrical connection common to three or more circuits. In mixer design, a bus usually carries signals from a number of inputs to a mixing amplifier, just like a city bus carries people from a number of neighborhoods to their jobs. It comes from the British “omnibus”.

## C

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### Cannon

A manufacturer of electrical connectors who first popularized the three-pin connector now universally used for balanced microphone connections. In sound work, a Cannon connector is taken to mean a Cannon XLR-3 connector or any compatible connector. You can tell an audio geezer because he refers to this connector as “Cannon”. Today the term “XLR” is more common.

### cardioid

Heart-shaped. In sound work, cardioid refers to the shape of the sensitivity vs. direction plot for a particular style of directional microphone. A cardioid mic rejects sound arriving from the rear.

### channel

A functional path in an audio circuit: an input channel, an output channel, a recording channel, the left channel and so on.

### channel strip

The physical realization of an audio channel on the front panel of a mixer; usually a long, vertical strip of controls.

### chorusing

A time-based effect available in some digital delay effects units and reverbs. Chorusing involves a number of moving delays and pitch shifting, usually panned across a stereo field.

Depending on how used, it can be lovely or grotesque.

## clipping

A form of severe audio distortion that results from peaks of the audio signal attempting to rise above the capabilities of the amplifier circuit. Seen on an oscilloscope, the audio peaks appear clipped off. To avoid clipping, reduce the system gain in or before the gain stage in which the clipping occurs. Also see headroom.

## common mode

A signal which is referenced to the circuit common point, usually chassis ground.

## compressor

This is a dynamics processor used to smooth out any large transient peaks in an audio signal that might otherwise overload your system or cause distortion. The amplitude threshold and other parameters such as attack time, release time, and tire pressure are adjustable.

## condenser

Another term for the electronic component generally known as a capacitor. In audio, condenser often refers to a type of microphone that uses a capacitor as the sound pickup element. Condenser microphones require electrical power to run internal amplifiers and maintain an electrical charge on the capacitor. They are typically powered by internal batteries or “phantom power” supplied by an external source, such as a mixing console.

## console

Another term for a sound mixer, usually a large desk-like mixer.

## crest factor

The ratio of the peak value to the RMS value. Musical signals can have peaks many times higher than the RMS value. The larger the transient peaks, the larger the crest factor.

## cueing

In broadcast, stage and post-production work, to “cue up” a sound source (a record, a sound effect on a CD, a song on a tape) means to get it ready for playback by making sure you are in the right position on the “cue,” making sure the level and EQ are all set properly. This requires a special monitoring circuit that only the mixing engineer hears. It does not go out on the air or to the main mixing buses. This “cueing” circuit is the same as pre-fader (PFL) solo on a Mackie mixer, and often the terms are interchangeable.

## D

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## D/A converter (DAC)

Digital-to-analog converter, a device that transforms incoming digital signals into analog form.

## damping

Damping factor is a number that represents the ratio of the impedance of the load to the output impedance of the amplifier. In practical terms, it is a measure of how well the amplifier can control the movement of a speaker's cone. The greater the damping factor, the better its ability to control the cone's movement. A low damping factor (high amplifier output impedance) allows a woofer to continue to move after the signal stops, resulting in an indistinct and mushy low frequency response. A high damping factor (200 or above) provides excellent control over low frequency woofers and produces a tight, clean bass.

## DAT

Digital Audio Tape is a recording/playback system where analog signals are converted to digital form and stored on magnetic tape. It offers all the benefits of digital audio including low noise and wide dynamic range.

## DAW

Digital Audio Workstation is a dedicated recording/editing software application and hardware system, used for hard disk (non-linear) random access recording and playback. Many DAWs are used with personal computers using Windows® or Macintosh® operating systems, though some use their own proprietary computers.

## dB

See decibel.

## dBA

Sound Pressure Level (SPL) measured with an "A" weighting filter.

## dBm

A unit of measurement of power in an electrical circuit, expressed in decibels referenced to 1 milliwatt. The "m" in dBm stands for "milliwatt." In a circuit with an impedance of 600 ohms, this reference (0 dBm) corresponds to a signal voltage of 0.775 VRMS (because 0.775 V across 600 ohms equals 1 mw).

## dBu

A unit of measurement of audio signal voltage in an electrical circuit, expressed in decibels referenced to 0.775 VRMS into any impedance. Commonly used to describe signal levels within a modern audio system. Nobody is really sure if "u" stands for anything.

## dBv

A unit of measurement equal to the dBu no longer in use in the US, but sometimes still in Great Britain. It was too easy to confuse a dBv with a dBV, to which it is not equivalent.

## dBV

A unit of measurement of audio signal voltage in an electrical circuit, expressed in decibels referenced to 1 VRMS across any impedance.

Commonly used to describe signal levels in consumer equipment. To convert dBV to dBu, add 2.2 dB.

## decibel (dB)

The dB is a ratio of quantities measured in similar terms using a logarithmic scale. Many audio system parameters measure over such a large range of values that the dB is used to simplify the numbers. A ratio of 1000:1=60 dB. Since dB is a unitless quantity, it doesn't matter if it's volts or dollars. (just try asking the chief engineer for a 3 dB raise) When one of the terms in the ratio is an agreed upon standard value such as 1.23 V, 1 V or 1 mw, the ratio becomes an absolute value, i.e., +4 dBu, -10 dBV or 0 dBm.

## delay

In sound work, delay usually refers to an electronic circuit or effects unit whose purpose it is to delay the audio signal for some short period of time. Delay can refer to one short repeat, a series of repeats or the complex interactions of delay used in chorusing or reverb. When delayed signals are mixed back with the original sound, a great number of audio effects can be generated, including phasing and flanging, doubling, Haas precedence-effect panning, slap or slapback, echo, regenerative echo, chorusing and hall-like reverberation. Signal time delay is central to many audio effects units.

## detent

A point of slight physical resistance (a click-stop) in the travel of a knob or slide control. Most knobs on Mackie mixers are detented to indicate their unity gain or centered position. It's handy in the dark.

## diffraction

The bending of sound waves around an obstacle (Huygens Principle). The longer the wavelength in comparison to the obstacle, the more the wave will diffract around it.

## dipping

The opposite of peaking, of course, used in audio to describe the shape of a frequency response curve. A dip in an EQ curve looks like a valley, or a dip. Dipping with an equalizer reduces a range of frequencies. (See guacamole.)

## dither

This is an interesting technique to reduce the audibility of low level noise in a digital recording. Low level random noise is added to the analog signal before the sampling stage, reducing an effect called quantization error.

## doubling

A delay effect, where the original signal is mixed with a medium (20 to 50 ms) delayed copy of itself. When used carefully, this effect can simulate double-tracking (recording a voice or instrument twice).

## dry

Usually means without reverberation, or without some other applied effect like delay or chorusing. Dry is not wet, i.e., totally unaffected.

## DSP

Digital Signal Processing can accomplish the same functions found in analog signal processors, but performs them mathematically in the digital domain, with more precision and accuracy than its analog counterpart. Since DSP is a software-based process, parameters and processing functions are easily changed and updated by revising the software, rather than redesigning the hardware. DSP can be found in an out-board effects device, such as a reverb or delay unit, or it can be integrated into a DAW or digital mixing console.

## dual mono

A mode of operation for a stereo amplifier that routes a single input to both channels, but still allows independent level control over each amplifier output.

## dynamic microphone

The class of microphones that generate electrical signals by the movement of a coil in a magnetic field. Dynamic microphones are rugged, relatively inexpensive, capable of very good performance and do not require external power.

## dynamics processor

A type of processor that only affects the overall amplitude level of the signal (sometimes as a function of its frequency content), such as a compressor, expander, limiter, or gate.

## dynamic range

The range between the maximum and minimum sound levels that a sound system can handle. It is usually expressed in decibels as the difference between the level at peak clipping and the level of the noise floor.

## E

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## echo

The reflection of sound from a surface such as a wall or a floor. Reverberation and echo are terms that are often used interchangeably, but in audio parlance a distinction is usually made: echo is considered to be a distinct, recognizable repetition (or series of repetitions) of a word, note, phrase or sound, whereas reverberation is a diffuse, continuously smooth decay of sound.

Echo and reverberation can be added in sound mixing by sending the original signal to an electronic (or electronic/acoustic) system that mimics natural echoes, and then some. The added echo is returned to the mix through additional mixer inputs.

## effects device or effect processor

An external signal processor used to add reverb, delay, spatial or psychoacoustic effects to an audio signal. An effects processor may be used

as an insert processor (serial) on a particular input or subgroup, or it may be used via the aux send/return system (parallel). See also echo, reverb.

## EIN

Equivalent Input Noise. A specification that helps measure the “quietness” of a gain stage by deriving the equivalent input noise voltage necessary to obtain a given preamp’s output noise. Numerically, it’s the output noise at a given gain setting minus the gain. EIN is usually measured at maximum gain and typically ranges from -125 to -130 dBm.

## EMI

Electro-Magnetic Interference. This refers to current induced into the signal path as a result of an external magnetic field. In audio systems, this is usually manifested as a 60 Hz or 120 Hz hum or buzz (50 Hz or 100 Hz in 50 Hz systems). The source of this noise can be from a ground loop or from the signal wire coming too close to a strong magnetic field such as a transformer or high-current linecord.

## EQ

Short for equalization.

## EQ curve

A graph of the response of an equalizer, with frequency on the x (horizontal) axis and amplitude (level) on the y (vertical) axis. Equalizer types and effects are often named after the shape of the graphed response curve, such as peak, dip, bell, shelf, or notch.

## equalization

Equalization (EQ) refers to purposefully changing the frequency response of a circuit, sometimes to correct for previous unequal response (hence the term, equalization), and more often to boost or cut the level at certain frequencies for sound enhancement, to remove extraneous sounds, or to create completely new and different sounds.

Bass and treble controls on your stereo are EQ; so are the units called parametrics and graphics and notch filters.

A lot of how we refer to equalization has to do with what a graph of the frequency response looks like. A flat response (no EQ) is a straight line; a peak looks like a hill, a dip is a valley, a notch is a really skinny valley, and a shelf looks like a plateau (or a shelf). The slope is the grade of the hill on the graph.

Aside from the level controls, EQs are probably the second most powerful controls on any mixer (no, the power switch doesn’t count!).

## F

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### fader

Another name for an audio level control. Today, the term refers to a straight-line slide control rather than a rotary control.

### family of curves

A composite graph showing on one chart several examples of possible EQ curves for a given equalizer or equalizer section.

### filter

A simple equalizer designed to remove certain ranges of frequencies. A low-cut filter (also called a high-pass filter) attenuates frequencies below its cutoff frequency. There are also high-cut (low-pass) filters, bandpass filters, which cut both high and low frequencies but leave a band of frequencies in the middle untouched, and notch filters, which remove a narrow band but leave the high and low frequencies alone.

### flanging

A term for an effect similar in sound to phasing. Before we had electronic delay units, flanging was accomplished by playing two tape machines in synchronization, then delaying one slightly by rubbing a finger on the reel flange. Get it?

## FOH

An acronym for Front Of House. See house and main house speakers. Nobody involved with audio ever goes to the Back of House because they never have time to drink enough beer.

## frequency

The number of times an event repeats itself in a given period of time. Generally the time period for audio frequencies is one second, and frequency is measured in cycles per second, abbreviated Hz, honoring the physicist Dr. Heinrich Hertz (who did not invent the rental car). One Hz is one cycle per second. One kHz (kilohertz) is 1000 cycles per second.

The audio frequency range is generally considered to be 20 Hz to 20,000 Hz. This covers the fundamental pitch and most overtones of musical instruments.

## G

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### gain

The measure of how much a circuit amplifies a signal. Gain may be stated as a ratio of input to output voltage, current or power, such as a voltage gain of 4, or a power gain of 1.5, or it can be expressed in decibels, such as a line amplifier with a gain of 10 dB.

### gain stage

An amplification point in a signal path, either within a system or a single device. Overall system gain is distributed between the various gain stages.

### gate

A dynamics processor that automatically turns off an input signal when it drops below a certain level. This can reduce the overall noise level of your mix by turning off inputs when they are not in use. Threshold, attack time,

hold, and release time are some of the adjustable gate parameters.

## graphic EQ

A graphic equalizer uses slide pots for its boost/cut controls, with its operating frequencies evenly spaced through the audio spectrum. In a perfect world, a line drawn through the centers of the control shafts would form a graph of the frequency response curve. Or, the positions of the slide pots give a graphic representation of boost or cut levels across the frequency spectrum. Get it?

## ground

Also called earth. Ground is defined as the point of zero voltage in a circuit or system, the reference point from which all other voltages are measured.

In electrical power systems, ground connections are used for safety purposes, to keep equipment chassis and controls at zero voltage and to provide a safe path for errant currents. This is called a *safety ground*. Maintaining a good safety ground is essential to prevent electrical shock. Follow manufacturer's suggestions and good electrical practices to ensure a safely grounded system. Never remove or disable the grounding pin on the power cord.

In sensitive electronic equipment, tiny currents and voltages riding on the ground (so it's not truly zero volts) can cause noise in the circuits and hamper operation. Often a ground separate from the power ground is used as the reference point for the electronics, isolating the sensitive electronics from the dirty power ground. This is called a *technical ground*.

Quality audio equipment is designed to maintain a good technical ground and also operate safely with a good safety ground.

## ground loop

A ground loop occurs when the technical ground within an audio system is connected to the safety ground at more than one place. This forms a loop around which unwanted current can, and does flow, causing noise in the audio



system. Never disable the safety ground in an attempt to solve hum problems.

## guacamole

Just kidding (see dipping).

## H

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### Haas precedence effect

A psychoacoustic effect in which the time of arrival of a sound to the left and right ears affects our perception of direction. If a signal is presented to both ears at the same time and at the same volume, it appears to be directly in front of us. But if the signal to one ear, still at the same volume, is delayed slightly, the sound appears to be coming from the earlier (non-delayed) side.

### headroom

The difference between nominal operating level and peak clipping in an audio system. A mixer with a nominal operating level of +4 dBu and a maximum output level of +22 dBu has 18 dB of headroom. Plenty of room for surprise peaks.

### Hertz

The unit of frequency, equal to 1 cycle per second. Abbreviated Hz. kHz 1000 Hz, and is usually pronounced “kay”(with “Hertz” implied) by sound professions who ask for “a little more two and a half K” when they want you to boost 2.5 kHz.

### house

In Sound Reinforcement parlance, “house” refers to the systems (and even persons) responsible for the primary sound reinforcement in a given hall, building, arena or “house.” Hence we have the house mixer or house engineer, the house mix, the house mix amps, the main house speakers and so on.

## Hz

Short for Hertz.

## I

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### impedance

The A.C. resistance, capacitance, and inductance in an electrical circuit, measured in ohms. In audio circuits (and other ac circuits) the impedance in ohms can often be much different from the circuit resistance as measured by a dc ohmmeter.

Maintaining proper circuit impedance relationships is important to avoid distortion and minimize added noise. Mackie input and output impedances are set to work well with the vast majority of audio equipment.

### input module

A holdover from the days when the only way that real consoles were built was in modular fashion, one channel per module. See channel strip.

### insert

Noun – a place where a signal path can be broken and a processing device placed in line with the signal. It’s usually a TRS jack with one conductor being an output (send) and the other being an input (return). The jack is wired with a *normalled connection* so that with nothing plugged in, the send and return are connected together, as if it wasn’t even there. In Mackie mixers, the *insert* jacks are wired with tip as send, ring as return, and sleeve as ground.

Verb – we don’t want to go there.

## J

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## K

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### knee

A knee is a sharp bend in a curve (an EQ frequency response or compressor gain curve) not unlike the sharp bend in your leg.

## L

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### level

Another word for signal voltage, power, strength or volume. Audio signals are sometimes classified according to their level. Commonly used levels are: microphone level (-40 dBu or lower), instrument level (-20 to -10 dBu), and line level (-10 to +30 dBu).

### line level

A signal whose level falls between -10 dBu and +30 dBu.

## M

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### main (house) speakers

The main loudspeakers for a sound reinforcement system. These are usually the largest and loudest loudspeakers, and are usually positioned so that their sound seems to come from the area of the main stage.

### mains

Short for *main* or *house speakers* in a sound reinforcement system.

### master

A control affecting the final output of a bus on which one or more signals are mixed. A mixer

may have several master controls, which may be slide faders or rotary controls.

### mic amp

See *mic preamp*.

### mic level

The typical level of a signal from a microphone. A mic level signal (usually but not always coming from a microphone) is generally lower than -30 dBu. With a very quiet source (a pin dropping?) the signal can be -70 dBu or lower.

Some microphones, notably vintage or vintage-style condenser mics, deliver a higher signal level than this for the same sound pressure level. A “hot” mic output level isn’t necessarily a measure of the microphone’s quality, it’s just an option that the designer chose.

### mic pre

Short for *mic preamp*.

### mic preamp

Short for microphone preamplifier. An amplifier whose job is to bring the very low microphone level signal up to line level, or in the case of a mic preamp built into a mixer, the mixer’s internal operating level (approximately 0 dBu).

Mic preamps often have their own volume control, called a trim control, to properly set the gain for a particular source. Setting the mic preamp gain correctly with the trim control is an essential step in establishing good signal-to-noise ratio and sufficient headroom for your mix.

### MIDI

Acronym for Musical Instrument Digital Interface. MIDI is the music industry’s standard serial communication protocol for the interface and control of musical instruments.

## mixer

An electronic device used to combine various audio signals into a common output. Different from a blender, which combines various fruits into a common libation.

## monaural

Long for *mono*. Literally, pertaining to or having the use of only one ear.

In the audio field, monaural describes a signal or system which carries audio information on a single channel with the intent of reproducing it from a single source. One microphone is a mono source; many microphones mixed to one channel is a mono mix; a stereo (or, to be picky, a two-channel) mix of many microphones panned left and right is a stereo mix of mono sources.

Monaural listening, and therefore mono compatibility of a stereo mix, is more important than you may realize. Most people hear television audio in mono. Most clock radios are mono.

## monitor

In sound reinforcement, monitor speakers (or monitor headphones or in-the-ear monitors) are those speakers used by the performers to hear themselves. In the video and broadcast world, monitor speakers are often called foldback speakers. In recording, the monitor speakers are those used by the engineer and production staff to listen to the recording as it progresses. In zoology, the monitor lizard is the lizard that observes the production staff as the recording progresses. Keep the lizard out of the mixer.

## mono

Short for *monaural*.

## mult

Short for *multiple*. In audio work, a mult is a parallel connection (in a patch bay or with specially built cables or wiring) used to feed an output to more than one input. A “Y” cable is a type of mult connection. Also used a verb, as in

“Why did you mult the flanger into every input in the board?”

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# N

## noise

Whatever you don’t want to hear. Could be hum, buzz or hiss; could be crosstalk or digital hash or your neighbor’s stereo; could be white noise or pink noise or brown noise; or it could be your mother-in-law reliving the day she had her gallstone removed.

## noise floor

The residual level of noise in any system. In a well designed mixer, the noise floor will be a quiet hiss, which is the thermal noise generated by electrons bouncing around in resistors and semiconductor junctions. The lower the noise floor and the higher the headroom, the more usable dynamic range a system has.

## normal

A wiring method which electrically ties together two jacks or two poles of one jack so that in *normal* operation, there is signal flow between them. Inserting a plug breaks this connection, allowing the signal path to be modified. *Normal* wiring is common in patchbays and *insert jacks*.

## Nyquist sampling theorem

This theorem states that, when an analog signal is converted to a digital signal, it must be sampled at a frequency that is at least twice the highest audio frequency present in the analog signal. If the audio frequency should exceed one-half the sampling frequency, aliasing can result. Thus, if an analog-to-digital converter is sampling at 44.1 kHz, the audio signal should not exceed 22.05 kHz.

# O

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# P

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## PA

Acronym for Public Address. Today, people who work with PA systems like to say they're working in "sound reinforcement". See SR.

## pan, pan pot

Short for panoramic potentiometer. A pan pot is used to position (or even dynamically move) a monaural sound source in a stereo mixing field by adjusting the source's volume between the left and right channels. Our brains sense stereo position by hearing this difference in loudness when the sound strikes each ear, taking into account time delay, spectrum, ambient reverberation and other cues.

## parallel mono

A mode of operation for a stereo amplifier that routes a single input to both channels, but combines the outputs of both channels into a single output by strapping the positive output terminals together, thereby providing twice the current of an individual output.

## patchbay

A collection of usually a large number of jacks allowing convenient access to various points in a system's interconnect wiring. A patchbay can make re-routing signals very convenient without having to fish around with cables in the back of racks or consoles. See *spaghetti*.

## parametric EQ

A "fully" parametric EQ is an extremely powerful equalizer that allows smooth, continuous, and independent control of each of the three primary EQ parameters: frequency, gain, and

bandwidth. "Semi" parametric EQs allow control of fewer parameters, usually frequency and gain (i.e., they have a fixed bandwidth, but variable center frequency and gain).

## peaking

The opposite of dipping, of course. A peak is an EQ curve that looks like a hill, or a peak. Peaking with an equalizer amplifies a band of frequencies.

## PFL

An acronym for Pre Fade Listen. Broadcasters would call it cueing. Sound folks call it being able to solo a channel with the fader down.

## phantom power

A system of providing electrical power for condenser microphones (and some electronic pickup devices) from the microphone input jack. The system is called phantom because the power is carried on standard microphone audio wiring in a way that is "invisible" to ordinary dynamic microphones. Mackie mixers use standard +48 volt DC power, switchable on or off. Most quality condenser microphones are designed to use +48 VDC phantom power. Check the manufacturer's recommendations.

Generally, phantom power is safe to use with non-condenser microphones as well, especially dynamic microphones. However, unbalanced microphones, some electronic equipment (such as some wireless microphone receivers) and some ribbon microphones can short out the phantom power and be severely damaged. Check the manufacturer's recommendations and be careful!

## phase

The time relationship between two signals, expressed in degrees around a circle. 0 and 360 degrees represents an in-phase relationship – both signals change in the same way at the same time. Anything else is out of phase.

180 degrees out of phase is a special case which, for a continuous waveform, means that at any given time the two signals have the same ampli-

tude but are opposite in polarity. The two legs of a differential output are 180 degrees out of phase. The *phase reverse* switch found on some mixers or mic preamps actually reverses the signal polarity.

When out-of-phase signals are mixed, there will be some cancellation at certain frequencies, the frequencies and the degree of cancellation being a function of the amount of phase shift and the relative amplitude of the signals. Attention to mic placement and careful listening will allow you to use this effect creatively.

## phasing

A dynamic effect in which the phase relationship between the fundamental and overtone components of a sound is continually changing. This is done by passing the signal through an automatically sweeping filter. The effect is often simulated by mixing original signal with a delayed (1 to 10 ms) version of itself. The time of the delay is slowly varied, and the combination of the two signals results in a dramatic moving comb-filter effect. A comb filter can be found in your back pocket.

## phone jack

Ever see those old telephone switchboards with hundreds of jacks and patch cords and plugs? Or the plug on the end of a headphone cable? Those are phone jacks and plugs, now used widely with musical instruments and audio equipment. A phone jack is the female connector, and we use them in 1/4" two-conductor (TS) and three-conductor (TRS) versions.

## phone plug

The male counterpart to the phone jack, right above.

## phono jack

Short for *RCA phono jack*.

## phono plug

Short for *RCA phono plug*.

## post-fader

A term used to describe an aux send (or other output) that is connected so that it is affected by the setting of the associated channel fader. Sends connected this way are typically (but not always) used for effects. A post-fader output from a mixer channel usually is also post-EQ. If pain persists, see your mixer's block diagram. Also see pre-fader.

## pot, potentiometer

In electronics, a variable resistor that varies the potential, or voltage. In audio, any rotary or slide control.

## pre-fader

A term used to describe an aux send (or other output) that is connected so that it is not affected by the setting of the associated channel fader. Sends connected this way are typically (but not always) used for monitors (foldback). See post-fader.

## proximity effect

The property of many directional microphones to accentuate their bass response when the source-to-mic distance is small, typically three inches or less. Singers generally like this effect even more than singing in the shower.

## Q

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## Q

A way of stating the bandwidth of a filter or equalizer section. An EQ with a Q of .75 is broad and smooth, while a Q of 10 gives a narrow, pointed response curve. To calculate the value of Q, you must know the center frequency of the EQ section and the frequencies at which the upper and lower skirts fall 3 dB below the level of the center frequency. Q equals the center frequency divided by the difference between the upper and lower 3 dB-down frequencies. A peaking EQ centered at 10

kHz whose -3 dB points are 7.5 kHz and 12.5 kHz has a  $Q$  of 2.

## quantization

The digital representation of an analog signal involves sampling the amplitude of the signal at a fast rate. Quantization is the measurement of the amplitude at the time of each sample, expressed as a digital word. Where an analog signal will be continuous as if it were going up a smooth path, quantization will have discrete steps (similar to stair steps).

## R

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### RAM

Random Access Memory is a type of computer memory that can be read from and written to.

### RCA phono jack

Long for *RCA jack* or *phono jack*. An RCA phono jack is an inexpensive connector (female) introduced by RCA and originally used to connect phonographs to radio receivers. The phono jack was (and still is) widely used on consumer stereo equipment and video equipment but was quietly fading into obscurity in the professional and semi-professional sound world. Then phono jacks began cropping up in early project-studio multitrack recorders, which (unfortunately) gave them a new lease on life. Since so many stereo recorders are fitted with them, we decided we'd have to put a couple on our mixers for your convenience. But make no mistake: the only thing that the phono jack (or plug) has going for it is low cost.

### RCA phono plug

The male counterpart to an RCA phono jack.

### regeneration

Also called recirculation. A delay effect created by feeding the output of a delay back into itself to cause a delay of the delay of the delay. You

can do it right on the front panel of many effects units, or you can route the delay return back into itself on your mixer. Can be a great deal of fun at parties.

Regeneration is also a fancy name for *feedback*. Feedback makes oscillators work and reduces distortion in amplifiers. Feedback in sound reinforcement systems, a form of oscillation itself, makes you popular with dogs and unpopular with musicians and audience alike.

### return

A return is a mixer line input dedicated to the task of returning processed or added sound from reverb, echo and other effects devices. Depending on the internal routing of your mixer and your own inclination, you could use returns as additional line inputs, or you could route your reverb outputs to ordinary line inputs rather than the returns.

### reverberation, reverb

The sound remaining in a room after the source of sound is stopped. It's what you hear in a large tiled room immediately after you've clapped your hands.

Reverberation and echo are terms that are often used interchangeably, but in audio parlance a distinction is usually made: reverberation is considered to be a diffuse, continuously smooth decay of sound, whereas echo is one or more distinct, recognizable repetitions of a word, note, phrase or sound which decreases in amplitude with every repeat.

Reverberation and echo can be added in sound mixing by sending the original sound to an electronic (or electronic/acoustic) system that mimics natural reverberation, or worse. The added reverb is returned to the blend through additional mixer inputs.

Highly reverberant rooms are called live; rooms with very little reverberation are called dead. A sound source without added reverb is dry; one with reverb or echo added is wet.

## RFI

Radio Frequency Interference. High frequency radiation that often results from sparking circuits. This can be manifested in a number of ways in audio systems, but is usually evident as a high-frequency buzz or hash sound.

## ROM

Read only memory is a type of computer memory that cannot be written to, but only read from.

## RMS

An acronym for root mean square, a conventional way to measure the effective average value of an audio signal or other AC voltage. Most AC voltmeters are calibrated to read RMS volts, though on many meters that calibration is accurate only if the waveform is sinusoidal.

## S

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### Sa value

A measure of the relative liveness of a room. A low Sa means a very live room, and a high Sa means a dead room.  $S$  = the total surface area of the room, and  $a$  = the average absorption coefficient of all the surfaces.

### sampling frequency

This is the rate at which an analog signal is sampled during the analog-to-digital conversion process. The sampling rate used for compact discs is 44.1 kHz, but professional recordings are often sampled at higher sample rates, such as 96 kHz or even 192 kHz (that's 192,000 samples per second!).

### send

A term used to describe the output of a secondary mix of the input signals, typically used for foldback monitors, headphone monitors or

effects devices. Mackie mixers call it an Aux Send.

### shelving

A term used to describe the shape of an equalizer's frequency response. A shelving equalizer's response begins to rise (or fall) at some frequency and continues to rise (or fall) until it reaches the shelf frequency, at which point the response curve flattens out and remains flat to the limits of audibility. If you were to graph the response, it would look like a shelf. Or more like a shelf than a hiking boot. See also peaking and dipping.

### signal-to-noise ratio (S/N)

This is a specification that describes how much noise an audio component has compared to the signal. It is usually expressed in dB below a given output level.

### slap, slapback

A single-delay echo without any repeats. Also see echo.

### solo

Italian for alone. In audio mixers, a solo circuit allows the engineer to listen to individual channels, buses or other circuits singly or in combination with other soloed signals.

### sound reinforcement

A system of amplifying acoustic and electronic sounds from a performance or speech so that a large audience can hear clearly. Or, in popular music, so that a large audience can be excited, stunned, or even partially deafened by the tremendous amplification. Means essentially the same thing as PA (Public Address).

### spaghetti

That mess of wires and cables in the back of your rack and/or console. You really *can* tame this.

## SR

An acronym for Sound Reinforcement, which refers to the process (or a system for) amplifying acoustic and electronic sounds from a performance or speech so that a large audience can hear clearly. Or, in popular music, so that a large audience can be excited, stunned or even partially deafened by the tremendous amplification. The term “SR” is to “PA” (Public Address) as the term “environmental cleanup technologist” is to “garbage collector”.

## steradians

Just as a radian is an angular unit of measure in 2-dimensional space, so a steradian is an angular unit of measure in 3-dimensional space (solid angle).

## stereo

Believe it or not, stereo comes from a Greek word that means solid. We use stereo or stereophony to describe the illusion of a continuous, spacious sound field that is seemingly spread around the listener by two or more related audio signals. In practice, stereo often is taken to simply mean two channels.

## surround sound

Multi-channel audio playback systems in four, five, or six channel formats. Surround sound is typically found in movie theaters and home theater systems.

## sweep EQ

An equalizer that allows you to “sweep” or continuously vary the frequency of one or more sections.

## symmetrically balanced

See *balanced*.

## T

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### tinnitus

The ringing in the ears that often results from prolonged exposure to very loud sound levels. A sound in the ears, such as buzzing, ringing, or whistling, caused by volume knob abuse!

### trim

In audio mixers, the gain adjustment for the first amplification stage of the mixer. The trim control allows the mixer to accommodate the wide range of input signal levels that come from real-world sources. It is important to set the trim control correctly; its setting determines the overall noise performance in that channel of the mixer. See *mic preamp*.

## TRS

Acronym for Tip-Ring-Sleeve, the three parts of a two-conductor (plus shield) phone plug. Since the plug or jack can carry two signals and a common ground, TRS connectors are often referred to as stereo or balanced plugs or jacks. Another common TRS application is for *insert* jacks, used for inserting an external processor into the signal path.

## TS

Acronym for Tip-Sleeve, the two parts of a single conductor (plus shield) phone plug. TS connectors are sometimes called mono or unbalanced plugs or jacks. A 1/4” TS phone plug or jack is also called a standard phone plug or jack.

## U

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### unbalanced

An electrical circuit in which the two legs of the circuit do not have the identical impedance to ground. Often one leg is also at ground poten-



tial. Unbalanced circuit connections require only two conductors (signal “hot” and ground). Unbalanced audio circuitry is less expensive to build, but under certain circumstances is more susceptible to noise pickup.

## unity gain

A circuit or system that has its voltage gain adjusted to be one, or unity. A signal will leave a unity gain circuit at the same level at which it entered – no amplification, but no loss either. In Mackie mixers, unity gain is achieved by setting all variable controls to the marked and usually detented “U” setting. Mackie mixers are optimized for best headroom and noise figures with all gain stages beyond the preamp set at unity gain.

## V

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### VLZ

Acronym for very low impedance, a Mackie design principle. VLZ is one of the most important reasons why inherent noise levels on Mackie mixing boards are so minuscule. Thermal noise is generated in all real world electronic components that have impedance. By keeping the impedances within the mixer circuitry low, Mackie keeps internal noise to a minimum.

### volume

The sound level in an audio system. Perhaps the only thing that some bands have too much of.

### VRMS

Acronym for Volts Root Mean Square. See *RMS*.

## W

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### wet

A signal with added reverberation or other effect like echo, delay or chorusing.

## X

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### XDR

Acronym for eXtended Dynamic Range. XDR is collection of Mackie circuit design elements which contribute to the low noise, high headroom mic preamp circuit employed on many Mackie mixers.

### XLR connector

See *Cannon*.

## Y

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### Y-Cable

A cable with one input and two outputs, used to *mult* a source to two inputs.

## Z

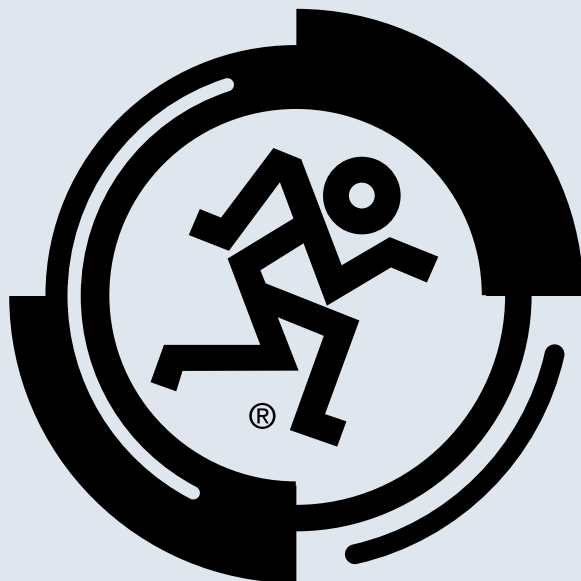
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### Z

The electrical symbol for *impedance*.

### zymurgy

The science of brewing, an important part of Mackie technology since the factory is located less than a mile from the Red Hook brewery. Besides, we needed something other than just plain “Z” to put in this A-to-Z glossary.



# **MACKIE®**

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